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Nutritional Anemia in Young Children with Focus on Asia and India

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Anemia prevalence in young children continues to remain over 70% in most parts of India and Asia despite a policy being in place and a program that has been initiated for a long time. The irreparable damage that anemia in childhood can cause particularly to the development of a young child on one hand and the knowledge and mechanism available for its control on the other, makes this silent morbidity completely unacceptable in modern times where we strive for millennium development Goal 4. This article reviews in detail the magnitude of child anemia and the mechanism for its occurrence, and deals, in detail, about what needs to be done, what difficulties we face, and how to overcome them, with the primary focus on iron-deficiency anemia (IDA).

Nutritional Deficiency Anemia in Children

The term 'nutritional anemia' encompasses all pathological conditions in which the blood hemoglobin concentration drops to an abnormally low level, due to a deficiency in one or several nutrients. The main nutrients involved in the synthesis of hemoglobin are iron, folic acid, and vitamin B_{12}. In public health terms, iron deficiency is by far the first cause of nutritional anemia worldwide. Folic acid deficiency is less widespread and is often observed with iron deficiency. Vitamin B_{12} deficiency is far rarer. Therefore, the focus in this article is on Iron-deficiency anemia in children.

Worldwide, at any given moment, more individuals have iron-deficiency anemia than any other health problem.[1] Anemia is the most common morbidity among micronutrients and affects health, education, economy, and productivity of the entire nation. Anemia, like fever, is a manifestation and not a disease *per se.* The most common group among the causes for anemia is malnutrition and among that group, iron deficiency makes up the bulk of it. A large portion of iron deficiency is preventable with appropriate and timely intervention. Iron deficiency is the most common nutritional disorder in the world. The numbers are staggering: two billion people — over 30% of the world's population — are anemic, mainly due to iron deficiency; and in developing countries this figure is frequently exacerbated by malaria and worm infections.[2] Iron deficiency affects more people than any other condition, constituting a public health epidemic. It exerts the heaviest overall toll in terms of ill-health, premature death, and lost earnings. The effects of anemia on children are the most dire because their bodies are still developing, including the brain, which is the fastest developing organ in infancy and early childhood.

Iron deficiency, and the anemia that results from it, is a major health problem affecting more than 3.5 billion people in developing countries, reducing vitality for the young and old alike, and impairing the cognitive development of children. Anemia is most often a hidden deficiency, with a few overt symptoms.[3] Policy makers often fail to recognize the massive economic costs, service providers often fail to recognize the significant health consequences, and societies are too often ignorant of anemia's capability to cause permanent cognitive defects, denying children their right to full mental and emotional development, before they ever reach a classroom.

Often programs and projects to prevent and control anemia have been constrained by the erroneous perception that effective and practical interventions are not available. These perceptions have their origin

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in poor implementation, rather than the availability of the interventions. It adds to the burden on the health systems, affects learning and school performance, and reduces adult productivity.

Iron-deficiency anemia can usually be prevented at a low cost, and the benefit/cost ratio of implementing preventive programs is recognized as one of the highest in the realm of public health. This information has equipped everyone in public health to take action against this longstanding problem and to do whatever is needed to be done.

Because anemia is the most common indicator used for screening iron deficiency, the terms 'anemia,' 'iron deficiency,' and 'iron-deficiency anemia' are often used interchangeably. However, prior to the development of iron-deficiency anemia, there have been mild-to-moderate forms of iron deficiency, where various cellular functions are impaired. We need to differentiate between, iron deficiency, anemia, and iron-deficiency anemia, to put each of them in their proper perspective.

Anemia

An abnormally low hemoglobin level due to pathological condition(s) is defined as anemia. Iron deficiency is one of the most common, but not the only cause of anemia. Other causes of anemia include chronic infections, particularly malaria, hereditary hemoglobinopathies, and folic acid deficiency. It is worth noting that multiple causes of anemia can coexist in an individual or in a population and contribute to the severity of the anemia.

Iron Deficiency

Iron deficiency (ID) is defined by an abnormal iron biochemistry with or without the presence of anemia. Iron deficiency is usually the result of inadequate bioavailable dietary iron, increased iron requirement during rapid growth, and increased blood loss for any reason. There are no current estimates of the total ID cases, but based on anemia as an indicator, it is estimated that most preschool children in developing counties are iron deficit[4]

Iron-deficiency Anemia

Anemia, when caused by severe iron deficiency is termed as iron-deficiency anemia (IDA). Although, some functional consequences may be observed in individuals who have iron deficiency without anemia. Cognitive impairment, decreased physical capacity, and reduced immunity are commonly associated with iron-deficiency anemia. In severe iron-deficiency anemia, the capacity to maintain body temperature may also be reduced. Severe anemia is also life-threatening. As the most common cause of anemia is iron deficiency, these terms are often used interchangeably. However, it is important to realize that anemia resulting from iron deficiency characterizes a very late stage of iron deficiency.

Table 1 shows the World Health Organization defined criteria for anemia cut off as measured by the hemoglobin.[4] This cut-off is used at sea level only and those who reside at a higher altitude will have a higher hemoglobin level, necessitating an adjustment to their level of hemoglobin consideration, in assessing anemia, so as to account for their physiological increase in hemoglobin.

Iron Metabolism and its Importance

Iron status can be considered as a continuum, which results from a long-term negative iron balance, where the iron stores are progressively lost. The total iron level in an adult man is 3.5 – 4 g. A major portion (73%) of the body's iron is normally incorporated into hemoglobin, a small portion of 12% is in the storage complexes as ferritin and hemosiderin, and a very important 15% is incorporated into a variety of other iron-containing compounds, some of them enzymes of vital importance. The heme iron compounds include myoglobin, cytochromes, catalases, and peroxidases. Infants and young children are the most adversely affected by iron deficiency because they are growing and developing at such a fast rate. If iron deficiency is not corrected, it leads to anemia and is associated with an impaired development of mental and physical coordination. Once afflicted, this impairment is not eradicated even after the anemia has been treated, impairing school achievement in older children.

Table 1: Hemoglobin level defining anemia[4]

Age and sex group	Hemoglobin values in g/dL				
	Non Anemic	Anemic	Mild anemia	Moderate anemia	Severe anemia
Children 6 – 59 Months	11.0 or more	< 11.0	10 – 10.99	7 – 9.99	< 7
Children 5 – 11 years	11.5 or more	<11.5	10 – 11.49	7 – 9.99	< 7
Children 12 – 14 years	12.0 or more	< 12.0	10 – 11.99	7 – 9.99	< 7
Non-pregnant women	12.0 or more	< 12.0	10 – 11.99	7 – 9.99	< 7
Pregnant Women	11.0 or more	< 11.0	10 – 10.99	7 – 9.99	< 7
Men	13.0 or more	< 13.0	10. – 12.99	7 – 9.99	< 7

*Source: WHO/UNICEF/UNU 2001(4)

Iron Balance

Almost all iron compounds in the body are continuously broken down and re-synthesized. The iron that is released is very efficiently conserved and reutilized. An important consequence of this recycling is that very little iron is lost from the body on a daily basis, except when bleeding occurs. The maintenance of iron balance in adults merely requires that the amount of iron absorbed from the diet be roughly equal to what is lost from the body. The amount of iron exchanged with the environment each day is a minute percentage of total body iron. In adult men, normal iron losses in the feces, sweat, and sloughed cells amount to about 0.9 mg/day, equivalent to less than 0.1% of the iron stores, and an even smaller percentage of the total body iron. This amount is readily absorbed from most diets. Women in their childbearing years must absorb an average of 1.3 mg/day to make up for the additional iron loss in menstrual blood. Women whose menstrual blood loss is unusually heavy and/or whose diet contains little absorbable iron are at risk of developing iron deficiency.[5]

In infants and children, a large amount of iron is required for growth (i.e., substantially more iron must be absorbed than is lost from the body). For example, a one-year-old infant loses about 0.2 mg of iron/day, calculated on the basis of body surface area, from values measured in adults. The amount needed for growth averages roughly 0.6 mg. Consequently, about 75% of the 0.8 mg of absorbed iron needed per day during this period, is for growth.

Pathophysiology of Anemia in Children under Three Years of Age

Hemoglobin concentrations are normally higher at birth than at any other time of life, as a result of the adaptation of the fetus to the hypoxic environment of the uterus. In addition, the neonatal reserves of storage iron are relatively generous. Consequently, most newborn infants are well supplied with iron. Between birth and four months of age, there is almost no change in the total body iron in the term infant. The need for exogenous iron is therefore modest during this period. The abundant iron stores present at birth help to provide for synthesis of hemoglobin, myoglobin, and enzyme iron during the first four months. Additional iron from the hemoglobin breakdown is also made available to meet the iron needs because the concentration of hemoglobin declines from a mean of 17.0 g/dl at birth to a low of 11.0 g/dl at two months of age. This low point used to be called the early anemia of infancy, and was distinguished from the 'late anemia of infancy,' because it was unresponsive to iron treatment.

After about four months of age, a gradual shift occurs from an abundance of iron to the marginal iron reserves that characterize the period of continued rapid growth. This window of vulnerability to iron deficiency is the major focus of concern. The transition from feast to famine with respect to iron is primarily due to the large amount of iron required to maintain a near constant mean hemoglobin concentration of 12.5 g/dl within a rapidly expanding blood volume between four and twelve months. A large amount of iron, about 0.8 mg/day, must be absorbed from the diet during this period. The rate and extent to which storage iron becomes depleted can be estimated from the changes in the concentration of serum ferritin and depends both on the magnitude of iron storage at birth and on the postnatal diet.

Mild maternal iron deficiency and anemia have few significant repercussions on the iron status of the newborn, but severe anemia does have a strong influence. The risk of an infant developing iron deficiency is further increased if the umbilical cord is prematurely clamped.[6] Both these risks are high in developing countries.

In the first two months of life, there is minimal dietary iron absorption and stores are mobilized to meet the iron requirement. Thereafter, dietary iron absorption becomes important and by four to six months of age, the iron stores have usually been depleted and diet becomes the vital source for iron. A low birth weight baby would have less iron stores and therefore would need extra iron as well as iron at an early age from the diet source.

The most common reason for iron-deficiency anemia in infants and children is the inadequate supply of iron in the diet. Iron is a mineral the body needs in order to make red blood cells. Children go through periods of rapid growth and the diet should supply enough to facilitate the increased need for more red blood cells. There are other situations when children may acquire this anemia. The infant may have been given low or non-iron fortified formula or breast-fed through the later months without supplementation of iron. This occurs in premature infants or low-birth weight infants. At other times the infant or child may have a gastrointestinal disease such as a chronic infection, chronic diarrhea, celiac disease or an intestinal parasite. However, the most common factor in infants, children, and adolescents, is the low intake of iron in the diet. Iron-deficiency anemia is common in young children because the child is growing rapidly at a time when the diet is typically low in iron content.

To summarize, the three main reasons for IDA in children are:

a. Poor bioavailability of iron consumed, related to the low consumption of absorption enhancers and a high consumption of absorption inhibitors in the second

year of life
b. Insufficient intake of iron as compared to the need
c. Increased requirement during the rapid growth stage of infancy and early childhood, between six and twenty-three months.

Magnitude of the Problem of Anemia in South East Asia

South East Asia has the largest number of anemic persons, both as an absolute number and also in proportion to its population, including children. Sixty percent women, 36% men, and 66% of the children in this region are anemic. This contributes to 324,000 deaths and 12,500,000 Disability Adjusted Life-Years (DALYs) in this region, which is the highest in the world.[7]

In Asia, the prevalence of anemia in children may exceed 90% for children under two years of age.[8] Figures for anemia prevalence in infants and very young children should be considered similar to those among pregnant mothers when the precise data is not available.[9]

Magnitude of Anemia in India's Children

Anemia has been a big problem in India and the National Family Health Survey (NFHS) III[10] data showed the prevalence of anemia among children less than five years of age to be around 70% [Table 2). When we look at the data for anemia prevalence among children under three years of age, it jumps to 79% and this is five percent more than the NFHS II[11] survey done six years prior to the NFHS III survey, which was done in 2005 – 2006 [Table 3]. However, it is noteworthy that there has been a slight reduction in the prevalence of severe anemia, while there has been an increase in the overall anemia, over the last seven years.

About 93 million children — eight percent of the total population of India estimated at 116 million in the year 2009 — are below the age of three. Nearly 73 million children below the age of three (79%) suffer from varying degrees of anemia, and over 50 million suffer from moderate-to-severe anemia. These figures of anemia prevalence, when compared to the current data and studies done in the 1970s and 1980s by the Indian Council of Medical Research (ICMR),[12] do not show any difference, indicating the persistence of India's anemia epidemic, believed largely to be due to iron deficiency.

Table 2 shows comparative levels of anemia in children among the different states of India. Mizoram, Goa, and Kerala are the states having anemia prevalence below 50%, while eight out of 26 states have anemia prevalence of more than 70%, with Bihar topping the list, with the highest anemia prevalence (78%) in children.

Table 2: Anemia prevalence among children six to fifty-nine months of age

	Mild anemia	Moderate anemia	Severe anemia	Total anemia
India	26.3	40.2	2.9	69.5
North				
Delhi	26.3	30.0	0.7	57.0
Haryana	25.8	42.2	4.3	72.3
Himachal Pradesh	25.7	26.8	2.2	54.7
Jammu and Kashmir	25.8	30.4	2.4	58.6
Punjab	21.7	38.1	6.6	66.4
Rajasthan	22.8	40.2	6.7	69.7
Uttaranchal	28.5	30.6	2.3	61.4
Central				
Chhattisgarh	24.0	45.2	2.0	71.2
Madhya Pradesh	27.1	43.6	3.4	74.1
Uttar Pradesh	25.4	45.0	3.6	73.9
East				
Bihar	29.6	46.8	1.6	78.0
Jharkhand	29.3	39.1	1.9	70.3
Orissa	28.9	34.5	1.6	65.0
West Bengal	30.0	29.4	1.5	61.0
Northeast				
Arunachal Pradesh	27.1	29.1	0.8	56.9
Assam	28.7	38.7	2.2	69.6
Manipur	25.6	15.2	0.3	41.1
Meghalaya	31.7	31.7	1.0	64.4
Mizoram	23.5	20.0	0.6	44.2
Sikkim	28.9	29.5	0.8	59.2
Tripura	27.5	34.6	0.7	62.9
West				
Goa	19.5	17.1	1.5	38.2
Gujarat	25.0	41.1	3.6	69.7
Maharashtra	21.9	39.6	1.8	63.4
South				
Andhra Pradesh	23.7	43.5	3.6	70.8
Karnataka	28.6	38.6	3.2	70.4
Kerala	23.5	20.5	0.5	44.5
Tamil Nadu	27.1	34.6	2.6	64.2

Source:[9]

This prevalence is among children six to fifty-nine months of age, with the highest concentration in that group being in children six to thirty-five months of age. As the data from the NFHS III study suggests, the highest prevalence is among the six to twenty-three months age group [Table 4].

Studies done prior to 1985, in India, gave an average prevalence rate of 68% in pre-school children.[13-15] The prevalence in different studies varied from 48 to 95%, placing all the states of India under the high magnitude category. However, this data is for children under five years of age and a specific age group of children under two years is not studied separately, where the prevalence is expected to be higher. Based on studies by the National Nutrition Monitoring Bureau,[16] anemia prevalence among children one to five years of age is around 66%, with a wide range of 33 to 93% across different states [Table 5]. Kotecha and Kotecha[17] studied anemia prevalence in children under three years of age in Vadodara urban slum and found anemia prevalence to be as high as 91%.

Consequences of Iron Deficiency and Iron-Deficiency Anemia in Children

Anemia is a serious condition that impacts cognitive development. The effects of iron deficiency that are observed in the first six months of life can lead to permanent brain damage. An afflicted child is likely to remain vulnerable to infection and continue to have lower immunity toward infection throughout childhood. Also, the overall appetite is reduced and this vicious cycle perpetuates a series of events that must be stopped, to ensure the child's health.

The Special Iron Needs of Children under Age Two

Until six months of age, normal-weight, full-term infants, who are born to healthy mothers and are exclusively breastfed receive enough iron from their own stored iron and breast milk. Their stored iron is exhausted after about six months. Additional iron is then required, because the iron content of unfortified conventional complementary foods is insufficient to meet the high iron requirements of growing six- to twenty-four-month-old infants and children. Infants and children who do not obtain adequate iron will suffer cognitive impairment that will affect their ability to learn and to perform income-earning tasks later in life. Iron supplements provided after 24 months of age may not correct this cognitive impairment.

Low birth weight infants, premature infants, and infants of mothers with anemia need additional iron starting at about two months of age, to build iron stores and meet the requirements of their rapid growth. Non-exclusively breastfed infants may also need small amounts of additional iron to compensate for the iron they do not receive through breast milk. The iron requirements of children with severe malnutrition and anemia need special attention.

Adopted from: PHNI/MEDS/USAID (2003),[18]

Although it is well established that iron-deficiency anemia among children is responsible for higher morbidity and subsequent mortality, systemic studies to quantify them are practically difficult for a number of epidemiological reasons, and therefore, are not available. Iron-deficiency anemia rarely exists in isolation, and to disentangle the proportion of the role played by anemia from the total level of malnutrition and other precipitating factors, although desirable, is difficult to get at the community level.

Table 3: Comparison of anemia prevalence among children of age six to thirty-five months[9,10]

Anemia level	NFHS III			NFHS II		
	Urban	Rural	Total	Urban	Rural	Total
Mild (10.0 – 10.9 g/dl)	25.8	25.7	25.7	23.7	22.7	22.9
Moderate (7.0-9.9 g/dl)	42.0	51.7	49.4	42.0	47.1	45.9
Severe (< 7.0 g/dl)	4.4	3.5	3.7	5.1	5.5	5.4
Any anemia (< 11.0 g/dl)	72.2	80.9	78.9	70.8	75.3	74.3

Source:[9,10]

Table 4: Prevalence of anemia among children by age

Age in months	Anemia prevalence in percentage				Number
	Mild (10.0 – 10.9 g / dl)	Moderate (7.0 – 9.9 g / dl)	Severe (<7.0 g / dl)	Total anemia (<11.0 g / dl)	
6 – 8	27.5	50.5	1.6	79.7	2204
9 – 11	27.6	51.7	2.4	81.7	2066
12 – 17	24.0	56.0	4.6	84.5	4599
18 – 23	23.8	53.4	4.4	81.6	4679
24 – 35	26.6	44.1	3.9	74.6	9355
36 – 47	27.3	33.1	2.7	63.0	9797
48 – 59	26.9	24.9	1.2	53.0	9688

Source:[9]

What is the Dose of Iron for the Treatment of Iron-deficiency Anemia in Children?

As the proportion of children having anemia is likely to be very high, the label of the child being anemic or non-anemic is an arbitrary cut off point of the hemoglobin level only. In general, the children are likely to be having some degree of iron deficiency and thus need iron supplementation. In case of frank iron-deficiency anemia, we may then call that as the treatment where the dose would be higher and the duration longer.

In the case of children who may have only Iron deficiency, the dose can be less, but the duration for prevention will not be shorter. Keeping these aspects in mind, the discussion that follows makes that distinction, to avoid repetition of related topics.

The most practical iron supplement for use in infants and young children is an aqueous solution of a soluble ferrous salt, such as ferrous sulfate, or a ferric complex, such as iron polymaltose. A single, safe dose that is effective for all children under two years old that can be easily dispensed by a non-literate mother is required.

Table 5: Prevalence (%) of anemia among children of age one to less than five years

States	n	Normal (≥ 11 g / dl)	Anemia			
			Mild (10 – 11 g / dl)	Moderate (7 – 10 g / dl)	Severe (< 7 g / dl)	Total (CI)
Kerala	369	66.3	20.1	13.3	0.3	33.7 (28.8,38.4)
Tamilnadu	407	37.3	22.4	36.1	4.2	62.7 (58.0,67.3)
Karnataka	425	33.6	20.7	43.3	2.4	66.4 (61.9,70.9)
Andhra Pradesh	448	29.2	24.8	42.2	3.8	70.8 (66.6,75.0)
Maharashtra	404	40.9	20.5	35.6	3.0	59.1 (54.3,63.9)
Madhya Pradesh	394	35.3	24.1	38.1	2.5	64.7 (60.0,69.4)
Orissa	407	7.6	22.1	69.8	0.5	92.4 (89.8,95.0)
West Bengal	437	18.8	34.1	47.1	0.0	81.2 (77.5,84.9)
Pooled	3291	33.1	23.7	41.1	2.1	66.9 (65.3,68.5)

Source:[16]

Requirement of iron for prevention and treatment of IDA depends upon:

1. The level of iron store for the child at the time of birth, which in turn depends on the iron status of the mother during pregnancy
2. Whether the child born is of low birth weight or normal birth weight
3. Whether the child is breast feeding exclusively, or with other foods, and if other foods, then whether they contain iron absorption inhibitors or iron absorption promoters
4. The quantity of food consumed and whether the bioavailability of iron from it is poor (5%) or good (up to 15%)

Based on this, the total dietary iron content requirement will be variably based on the level of anemia and other factors contributing to anemia, such as infection. The discussion that follows should take all these factors into account.

How Much Iron is Required?

For therapeutic purposes, an adequate and safe hematological response to oral iron intake can be achieved in four to six weeks with three milligrams of elemental iron / kilogram body weight / day.[19] In a prophylactic program, between one and two milligrams of iron / kilogram body weight / day is appropriate. Assuming five percent iron absorption, which is a very conservative estimate of absorption,[20] a 12.5 mg dose is equivalent to 2.5 mg. / kg body weight for a six-month-old child with an average weight of 5 kg; 1.6 mg / kg body weight for a 12-month-old infant weighing 8 kg; and 1.2 mg. / kg body weight for an 18-month-old infant weighing 12 kg.[2]

The total iron requirement remains at 0.7 mg. / per day for infants up to 18 months of age and is not dependent upon the body weight. Thus, the 12.5 mg dose would also meet almost 90% (assuming 5% of absorption from the dietary iron intake) of the estimated total iron requirement of children six to eighteen months old. Where the iron absorption is higher because of low iron stores, the upper safe limit of intake would not exceed with this dose. If compliance were poor, and children were dosed the equivalent of every other day — between 35 – 45% of the iron requirement would be available from the iron supplement alone.

Efforts to Control Anemia among Children in India

The goals of the Government of India's tenth five-year plan[21] for anemia control for children includes:

1. Screening of children for anemia wherever required and appropriate treatment for those found to be anemic
2. Reducing the prevalence of anemia by 25% and moderate and severe anemia in children by 50%

Unlike other countries where the policy refers to anemia control, but there is no specific intervention program, in India, the Nutritional Anemia Prophylaxis program is in existence since 1970. As anemia has continued to be highly prevalent among children, the program has been re-designated as the National Nutritional Anemia Control Program in 1991. This program aims at decreasing the incidence of anemia among the vulnerable sections of the population, namely pregnant and lactating women, intrauterine device (IUD) users, and children in the one-to-five year age group. For children between 12 and 59 months the program prescribes one tablet of 20 mg elemental iron and to treat children found clinically anemic 100 ?g of folate for 100 days in a year.

The program is envisaged to be implemented as part of the RCH II package now and is being implemented through the existing health system and Integrated Childhood Development Scheme (ICDS) run by the Department of Women and Child Development. Studies suggest that iron and folic acid (IFA) tablets given to young children under the age of three years is not well-accepted and efforts have been made to recommend that liquid IFA be replaced by IFA tablets

Table 6: Guidelines for iron supplementation to children six to twenty-four months of age

Prevalence of anemia in children 6 – 24 M	Dosage	Birth-weight category	Duration
< 40%	12.5 mg. iron + 50 microgram folic acid daily	Normal	6 – 12 months of age
		Low birth weight (< 2500 g.)	2 – 24 months of age
≥40%	12.5 mg. iron + 50 microgram folic acid daily	Normal	6 – 24 months of age
		Low birth weight (< 2500 g.)	2 – 24 months of age

Source:[2]

for young children.[22] This recommendation has been endorsed in the Government of India's policy in the year 2007,[23] and it further endorses the requirement of iron supplementation to children below one year of age as well [Table 6]. Therefore, according to the new policy the recommendations are as follows:

1. Children from six to sixty months will be given one milliliter of IFA syrup for 100 days in a year. One milliliter of syrup will contain 20 mg elemental iron and 100 micrograms of folic acid
2. For safety reasons, the bottle should be dispensed in a way that only one milliliter can be dispensed at a time

The program does not envisage how to decide these 100 days and who exactly will deliver this IFA syrup and when. The program has clear guidelines for pregnant and lactating mothers and the logistics have been clearly worked out. Even in pregnant and lactating mothers, compliance has been far from satisfactory and for children's anemia control there is no monitoring system in place, leaving the implementation fairly weak. There are a number of components like vaccine coverage and vitamin A coverage that are being monitored, but not IFA supplementation. This differential treatment explains the lower priority and poor implementation of the program for anemia control in children.

A nationwide study done by the National Nutrition Monitoring Bureau covering eight states and 2178 children of age one to five years covered in the study[15] indicates that only 3.8% of these children received IFA tablets and half of them got it from an Anganwadi Workers (AWW), while the remaining half got it from a multipurpose female health worker. Actually the number of children who got IFA ranged from zero to five percent in different states except one State where it was 11% [Table 7]. This very study documented that children had anemia prevalence as high as 67%, with 43% having moderate-to-severe anemia. This reflects the state of the actual program that is so different from what would be expected, looking at the Tenth Five-year Plan. High anemia prevalence documented by the studies and surveys such as the NNMB, and the lack of monitoring are indicators from the routing management information systems, which speak of the actual state of the program that is in total disarray at the implementation level. As

Table 7: Distribution of children according to receipt of IFA tablets under the program – one- to less than five-year-old children

States	N	Received IFA tablets (%)
Kerala	117	1.7
Tamilnadu	218	4.1
Karnataka	323	2.2
Andhra Pradesh	352	1.1
Maharashtra	288	11.8
Madhya Pradesh	297	4.4
Orissa	332	3.9
West Bengal	251	0
Pooled from all States	2178	3.8

Source:[16]

anemia prevalence among children actually increased at the end of the Tenth Five-year plan, as indicated by the NFHS III study, the targets are continued in the Eleventh Five-year plan.[24] Consumption of IFA (preferably syrup for a young child) for 100 days, irrespective of the clinical judgment, is planned, in order to control the prevalence of child anemia. This calls for a contact with health personnel capable of clinically judging whether or not a child is anemic in the first place.

Conclusion

Issues in estimating the anemia problem due to Iron deficiency

Anemia in any form is harmful and the consequences that are discussed are applicable to all types of anemia. However, all types of anemia are not manageable in the same manner, and the genetic causes of anemia, like thalassemia or sickle-cell anemia need to be attended to differently and the expected results of the interventions will be different and relatively lesser and slower than iron-deficiency anemia interventions. So how do we estimate what proportion of anemia is due to which cause?

At the field level, hemoglobin estimation is the only method available for diagnosis of anemia, besides clinical assessment. Various other indicators like serum ferritin estimation, transferrin saturation and Erythrocyte Protoporphyrin have their own technical and financial limitations and are not commonly available for larger sections of the society. Even when all options are available, they do better than hemoglobin alone, but still have their own limitations. However, iron deficiency is the most common cause, at least in developing countries, assuming that iron-deficiency anemia prevalence based on anemia prevalence is justified at the management level.

Issues in management of childhood anemia

Anemia needs to be immediately attended to. Strategies and documents endorse this need. WHO / UNICEF / UNU[4] strongly advocate that when there is a prevalence of anemia above 40%, a universal supplementation is required and it is not cost-effective to screen children for anemia. This is in light of the fact that iron deficiency is almost universal when dealing with this magnitude of anemia. However, clinically speaking, many technical experts believe that to differentiate severe anemia, a screening is desirable and that is reflected in India's Tenth Five-year Plan's[21] nutritional goals, where all children are recommended to be screened.

What is important and needs to be emphasized is that universal intervention need not wait until this screening, and that screening is done primarily with the aim of finding children afflicted with severe anemia that may not be corrected with the current program and would need specific treatment.

At the national level, a workshop was organized at the National Institute of Health and Family Welfare, by the Government of India on 6 February, 2008. Technical experts from the country and international agencies attended this meeting and recommended specific actions that re-emphasized the universal supplementation of IFA syrup among young children

There is also a brighter side to anemia control, among children. So widespread is anemia in children — particularly in India and South East Asia — that although long awaited, it is now getting the recognition and attention it rightfully deserves. Now, most countries speak of anemia control in their health planning documents. International agencies have started supporting child anemia control. Millennium development goals aimed at the reduction of infant and maternal mortality will have to address anemia as it is a common problem with serious consequences for both these groups.[25]

However, it is disheartening, that at the implementation level not much is being done about childhood anemia in most countries. In India, where the program is in place, it is not being implemented at any significant level. The small amount of data that exists regarding the program points to poor implementation. In a regular monitoring of the program, anemia control for children was not available. Form Nine — used at the national and state levels in India for the Management Information and System (MIS) of the Reproductive and Child Health (RCH) program — did not include anemia control for children in its format. The revised monitoring formats also did not include IFA syrup distribution.

It is therefore recommended that we need to bridge the gap between our desire to control and reduce anemia among children and our lack of action and apathy toward implementing an effective program in anemia control among children. We need to emphasize, train, support, and effectively monitor the program's implementation, and systematically and realistically plan out logistics, supply, monitoring, and implementation of the program at the regional, national, state, and district levels. Only then will this scourge of children, that is, anemia, be adequately controlled and the fruits that the program promises will actually be delivered.

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